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ABSTRACT

A study tested the effects of activity-based phonological instruction (rhyming, blending, segmenting) on the phonological skill development and reading and writing outcomes of kindergarten children, 31 with and 57 without disabilities, and 19 children repeating kindergarten in regular and self-contained classes in a large urban school district. The ethnic distribution in the school district was 52% Black American, 46% Caucasian, and 2% other. Five classroom teachers in the treatment received 10 inservice training sessions spaced over the school year, and implemented from 98-280 activities during the 6-month treatment. Outcomes for treated children were compared with those of children matched for type (regular or repeating kindergartners, or children with mild disabilities) in classrooms using the same background prereading curriculum. Results suggested that intervention delivered by kindergarten teachers can be an effective way to improve the literacy outcomes of children with a broad range of abilities. As a feasibility test, this study suggests that classroom teachers can improve the phonological skills of their students prior to formal teaching instruction; but to make large and lasting differences in the reading trajectory of children with disabilities, instruction may need to be much more intense than that delivered to large classroom groups. (AA)

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LADDERS TO LITERACY: THE EFFECTS OF TEACHER-LED PHONOLOGICAL ACTIVITIES FOR KINDERGARTEN CHILDREN WITH AND WITHOUT DISABILITIES

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This study was designed to test the effects of activity-based phonological instruction (e.g., rhyming, blending, segmenting) delivered by five classroom teachers on the phonological skill development and reading and writing outcomes of kindergarten children with ($n = 31$) and without ($n = 57$) disabilities, and children repeating kindergarten ($n = 19$) in regular and self-contained classes. Teachers in the treatment received 10 inservice training sessions spaced over the school year, and implemented from 98-280 activities during the six-month treatment. Outcomes for treated children were compared with children matched for type (regular or repeating kindergartners, or children with mild disabilities) in classrooms using the same background prereading curriculum. Results suggest that intervention delivered by kindergarten teachers can be an effective way to improve the literacy outcomes of children with a broad range of ability.

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Ladders to Literacy: The Effects of Teacher-led Phonological Activities for Kindergarten

Children with and without Disabilities

Phonological awareness is the ability to blend, segment, rhyme, or in other ways manipulate the sounds of spoken words. In kindergarten, these abilities predict reading achievement independently from letter knowledge, vocabulary, and IQ (Bradley & Bryant, 1985; Uhry, 1992; Wagner, Torgesen, Laughon, Simmons, & Rashotte, 1993). Converging evidence on the role of phonological awareness in learning to read (Adams, 1990; Ehri, 1992; Gough, Juel, & Griffeth, 1992; Hatcher, Hulme, & Ellis, 1994; Wagner et al., 1993) suggests that phonological processing leads to apprehension of the alphabetic principle (Byrne & Fielding-Barnsley, 1989)--that spoken words are composed of sounds which are represented by letters in our code of writing--and ultimately to improving the ease of acquisition of beginning reading skills in First Grade. Evidence for a causal connection was strengthened by the findings from controlled experiments in which researchers taught phonological blending and segmenting to young children, and demonstrated gains in reading acquisition over control groups (Bradley & Bryant, 1985; Cunningham, 1990; O'Connor, Jenkins, & Slocum, in press; Torgesen et al., 1992). These studies concluded with a recommendation to add phonological skills to the kindergarten curriculum; nevertheless, current curricula include very little in the way of phonological instruction beyond rhyming and identifying the first sound in words.

Implementation in Kindergarten Classrooms

Several features of experimental interventions with phonological skills pose problems for translation in real world classrooms. The interventions entailed the direct instruction of blending and/or segmenting to individuals or small groups of relatively homogeneous children, and these procedures have obvious limitations in the context of typical kindergarten classrooms in which one teacher interacts with 20 or more students across a broad range of abilities. Moreover, the effects of training were derived through instruction conducted by research personnel. The studies which have yielded strong results have been conducted under experimental conditions, and have required trained assistance and extra personnel usually unavailable in public schools.

Our goal was to explore the effects of teaching typical kindergarten personnel to conduct phonological activities that foster the skills that have yielded strong phonological and reading gains in more controlled experiments. We designed this study to incorporate routine classroom factors into the conditions of implementation: teachers delivered instruction; activities were used with intact groups of students; group sizes were determined by existing class sizes; assistance from other adults was limited to normally available personnel; and the duration of the intervention was the

school year. The first problem addressed in this current study was how to translate research on effective intervention in phonological manipulation into activities and procedures appropriate for typical kindergarten classrooms which include a wide range of student ability, including children with disabilities.

Instruction for hard to teach children

There are reasons to suppose that treatment effects may differ between typical learners and very hard to teach youngsters. The intervention studies which stirred initial interest in phonological awareness used average learners as subjects (Bradley & Bryant, 1983; Ball & Blachman, 1991; Cunningham, 1990); more recently experimenters have selected children at risk for reading failure to provide a more stringent test of the phonological ability-reading linkage (Hatcher et al., 1994; O'Connor et al., in press; Torgesen et al., 1992).

Studies of first grade phonological instruction in Denmark and Sweden (Lie, 1991; Torneus, 1984) found stronger effects on reading and spelling for children who began instruction with below-average phonological skills. This finding supported a threshold argument: that some level of phonological skill may be necessary for children to learn to decode words; however, beyond this level, higher attainment in phonological skills adds no advantage; thus the goal of treatment may be to bring more children over this threshold. Many average and above-average children may be at or beyond these threshold levels prior to beginning intervention, and increasing the phonological skills of these children may have negligible effects on their reading development. This hypothesis has not been tested with kindergarten-aged children.

We may also find that the effects of phonological skills instruction for children with mild disabilities differ in substantial ways from those found with more generically "low-skilled" children. The exclusionary criteria of kindergarten intervention studies usually reject children with IQ or receptive language scores more than one standard deviation below the mean (Ball & Blachman, 1991; Vellutino & Scanlon, 1987), those with behavior difficulties, eligible for special education services, or whose phonological skills are very low (Torgesen et al., 1992). In studies of preschool children, effect sizes for early intervention tend to be lower for children with disabilities than for children "at risk" for economic factors (Bryant & Ramey, 1987; Innocenti & White, 1993). More specifically, studies that include information on the progress of the very lowest skilled subjects report a substantial failure rate for a subset of the sample, even when experimental results are generally and statistically positive. For example, over 30% of the low-skilled children in the Torgesen et al. (1992) study failed to make measurable progress in segmentation. Although moderate success has been reported in teaching phonological skills to preschool and kindergarten-age children with developmental delays (O'Connor, Jenkins, Slocum,

& Leicester, 1993), 30% of these children failed to learn blending, and 50% failed to learn to segment during the seven-week intervention. It is also possible that a certain percentage of children can be expected to remain intractable to phonological instruction. Wagner et al. (1993) argued that phonological skills represent a relatively stable construct, which is also linked (but not synonymous) with cognitive ability, such that it could be very difficult to shift the phonological processes in some children.

This study addresses issues related to practical implementation of phonological instruction for kindergartners, by testing a model for teaching classroom teachers to implement phonological activities in their classes, and exploring the effects these activities have on children with and without mild disabilities or other risk factors. The research questions are: (1) Can classroom teachers incorporate phonological instruction into their regular, whole group routines? (2) What effect will such instruction have on the phonological, reading, and writing outcomes for the treated children? (3) Are there differential effects of treatment for the children across risk categories for reading failure (regular kindergartners, repeating kindergartners, and children with mild disabilities)? and (4) Can threshold levels for phonological skills be identified for kindergarten children?

Method

Participants

The children were enrolled in three kinds of kindergartens in a large urban school district: regular kindergartens (which included a few students with mild disabilities), transition kindergartens (for children repeating the kindergarten year), and self-contained kindergartens for children with mild disabilities (learning disabilities, behavior disorders, or mild mental retardation). The ethnic distribution in the school district was 52% Black American, 46% Caucasian, and 2% other.

The regular kindergartens. Three regular kindergarten teachers agreed to participate in this study. Prior to pretesting the children, we selected the two regular kindergartens which included the most children with disabilities--5 children all together in two classes: 2 students labeled mentally retarded (MR), 2 learning disabled (LD), and 1 with a behavior disorder (BD)-- so that we could assess the relative effects of treatment delivered by the regular teacher across student type. The third class, which included one student with a disability, was assigned to control status. To find additional children to serve as controls for the children with disabilities, we selected four children from four regular kindergarten classes who matched the children in the treatment classes

on type of disability, PPVT-R scores, and reading and dictation scores on the Woodcock-Johnson Tests of Achievement (within five standardized score points).

Children repeating kindergarten. Children who repeat kindergarten in this district tend to be instructed in self-contained transition classes with a reduced class size (12-15 students, compared to 21-25 students in the regular kindergartens), and a heavier emphasis on beginning reading and writing, including an extra 15-minute small group reading lesson. Two teachers of children repeating kindergarten agreed to participate. Each class included two students with disabilities, all with mild MR. The class in the closest proximity to other experimental classes was selected for treatment to facilitate delivery of inservice.

The children in self-contained classes. This district had three self-contained kindergartens for children with mild disabilities, but the class groupings were not comparable. One class was composed of children needing speech/language services, one of a mix of children with mild mental retardation, behavioral disorders, and learning disabilities, and the third the kindergarten-age children with autism, as well as milder disabilities. The first two teachers agreed to participate. We have no appropriate controls for children in the self-contained classes, thus we considered their phonological and reading growth apart from the treatment/control comparisons.

Background conditions for the kindergarten classes. For all of the kindergartens in this district, a new reading curriculum (Macmillan) was implemented at the beginning of the year which included an emphasis on letter names and letter/sound correspondence (taught through examples of words which began with the target letter), daily story book reading (many with a rhyming emphasis), copying activities, and discussion which related personal experience to books and classroom themes. The teachers in the treatment and control classes attended inservice together on implementing this curriculum in August and December of the year of this study. They began the new reading program in mid-September, and proceeded through the curriculum following the same sequence and general time frame in all classes.

Measures

Descriptive measures. We administered the *Peabody Picture Vocabulary Test-Revised* (PPVT-R; Dunn & Dunn, 1981), a short-term memory task in which children repeated isolated phonemes spoken by the examiner ("Let's play copy cats. Say exactly what I say: /p/ /i/ /f/"), and a test of timed letter naming in November and May.

Phonological Measures. The pretest and posttest tasks each included three unscored practice items with feedback, and an opportunity for the child to repeat the correct response. Following each testing item, the examiner wrote the child's response and then provided the correct response.

Rhyme production. Following an explanation and examples, the examiner gave the instruction: "Say a word that rhymes with *make*." Correct responses included real or nonsense words. For incorrect responses, the examiner modeled correct alternatives.

First sound. Identifying the first sound is the first stage in segmentation. In this 10-item task, the examiner said, "Tell me the first sound in *sick*." Items were scored correct if the child provided *only* the first sound (e.g., for *pill*, /p/ or /puh/ was correct; /pi/ was not).

Blending. Ten items were presented as 3 phonemes separated by a brief pause (e.g., The examiner said, "What word is this? s--oa--p"). Correct responses were awarded 2 points, and the examiner provided the answer for missed words. Next, the examiner presented any missed items in onset-rime format (e.g., s--oap), and correct responses were awarded 1 point.

Segmenting. Children segmented 10 words into 3 separate phonemes (e.g., The examiner said, "Make. Tell me the sounds in make."). Children received 1 point for each correctly segmented portion of the word (1-3 points per word).

Literacy Measures. *Woodcock-Johnson Tests of Achievement* (WJ: Woodcock & Johnson, 1990). We selected 2 subtests of the WJ to assess reading and writing during the pretest and posttest phases. In the letter-word identification subtest, the examiner shows children letters (items 5-13) or words (items 14 on), and children say the letter name or read the word. On the dictation subtest, the examiner directs the child to write a letter in upper or lower case (items 7-11), add punctuation to a sentence (item 12), or write words (items 13 on). Scores standardized by age are reported (mean of 100, standard deviation of 15). An average-performing 6-year-old at the end of kindergarten would have raw scores around 15 on the letter-word and 12 on the dictation subtest.

Procedure

Pretests. Pretests were administered by trained research assistants to all children in the treatment and control classrooms in November of the kindergarten year. We also tested potential participants with disabilities in four other integrated classes in the same school district to form matches for the children with disabilities in the treatment kindergartens.

Teacher training. Beginning the first week in December, and continuing approximately every three weeks through May, we conducted inservice training in small groups of special, transition, and regular educators, and teaching assistants from the special and regular education programs. Sessions included materials, the conceptual basis for each activity, practical suggestions for implementing each activity in the class routines, and feedback on implementation of earlier activities. Staff learned to conduct the same activities in all classrooms, and to implement them at the same pace over the school year. We visited special education classrooms weekly, and

other classes bi-weekly. These visits extended teacher training to address particular classroom concerns, and resulted in modifications to some of the activities (e.g. larger displays for the regular kindergartens), additional suggestions to teachers for implementation (e.g., visual cueing to guide group responding), and model teaching when requested by teachers or assistants (e.g., the first author occasionally conducted an activity with the most difficult to teach students when teachers raised questions about student involvement or learning).

The phonological activities. Over the six month intervention period, teachers learned to implement the 25 activities which comprised the treatment (see Table 1). Activities in the first two months were designed to stimulate word and syllable awareness (e.g., teachers conducted finger point reading, labeled classroom materials, played syllable clapping games, made a chart of the day's activities, wrote words dictated by children, and wrote a morning message dictated by children in their classes). Activities in months three and four stimulated rhyming, first sound isolation, and onset-rime level blending and segmenting. Children played *Guess My Word* ("I'm thinking of an animal: sn--ake"), matched rhyming pictures in card decks, and touched Elkonin boxes (Elkonin, 1983) as they said words in onset-rime format. In the last two months, we added letters and their sounds to phonological activities (e.g., "Find the letter that starts *Max*"); showed children how to use a letter sound to match pictures that start the same; and made the auditory blending games more sophisticated by separating each spoken phoneme. In the regular kindergartens, teachers conducted these activities in short (5-15 minute) sessions with their whole group of 21-25 students. In the transition classes and self-contained special education classes, the teachers and assistants usually conducted activities in smaller groups of 3-6 students, except for the Morning Message, I Found, and songs, which were whole group activities in all classes.

Fidelity of treatment. Fidelity was assessed in two ways. First, all teachers kept a daily Activity Log, which tracked the activities they used, how often, and any modifications in activities for particular children. These logs were collected weekly, and indicated that teachers implemented one to three activities daily, with the self-contained special education teachers implementing more activities than teachers in the larger classes (frequencies are shown in Figure 1). Special educators made more modifications for individual children than either the regular or transition teachers. Second, we observed weekly in special education classes, and bi-weekly in all other classes, while teachers were conducting activities.

The control classrooms. Children in the regular kindergarten control class, the four classes from which other control children with disabilities were selected, and the control transition class used the same background reading curriculum as the treatment classes. Their lessons included naming letters and saying their sounds, selecting rhyming pictures on worksheets, and identifying

the first sound in spoken and printed words. The control transition class also included finger point reading of Big Books. Control classes did not practice auditory blending, segmenting words beyond the first letter, or selecting letters to represent sounds. Because all of the treatment and control classes followed the same reading curriculum, the phonological activities of the treatment classes were in addition to normal prereading instruction.

The posttests. A research assistant, blind to treatment status, readministered the PPVT-R to all children in April, the phonological measures in mid-May, and the WJ subtests during the last week in May.

Results

First we present the results on the implementation of activities by teachers in regular and transition kindergartens, and self-contained classrooms. Then we examine the effects of participation in phonological activities for children with and without disabilities in regular and transition classrooms, compared to controls; then we present results regarding differential treatment effects as a function of disability and placement, including children in self-contained classrooms. Finally, we examine the relations between levels of phonological skills and reading and writing outcomes.

Implementation of Activities

Our discussions with teachers, observations of classrooms, and the activity logs we collected weekly all indicated that teachers differed in the number of activities they implemented daily with their classes (range = 1-4 daily). The total number of activities used ranged from a low of 100 activities in one of the regular kindergartens, to a high of 281 in one of the self-contained special education classrooms over the 97 teaching days in this study. Table 1 shows the variety of activities, and the range of implementation of each group of activities for each type of classroom (regular, transition, or special education). For the total number of activities used, the groups were distinct, with the two regular educators implementing the fewest, the two special educators implementing the most, and the transition class in between.

Table 1. Types of Activities and Frequencies of Use, by Class Type

Types of Activities	Range of Implementation in Each Class Type		
	Regular K (n = 2)	Transition K (n = 1)	Special Ed (n = 2)
<u>Low-level Skills</u>	range 9-27	18	range 62-63
Clap syllables			
Rhyming pictures			
Describing items			
Nursery rhymes			
<u>Blending & Segmenting</u>	range 51-53	85	range 52-88
First sound			
Blend, segment onset-rime			
First/last sound			
Blending phonemes			
Elkonin boxes (3)			
First sound song			
<u>Books and Writing</u>	range 36-51	67	range 73-129
Fill in the Blanks			
Morning Message; I Found			
Finger-point reading			
Making Books			
Post Office			
Blend/segment book words			
Total Activities Implemented	range 100-131	172	range 189-281

Pretests

We conducted multivariate analyses of variance (MANOVA) on descriptive measures and pretests scores, first to test for differences by student type (all regular, repeating kindergarten, or special education), and then to test for comparability between groups assigned to treatment or control conditions.

Regular kindergartners, repeating kindergartners, and children with disabilities. A MANOVA of pretreatment measures by student type (regular or transition kindergartners, or children with mild disabilities) was significant, Wilks's lambda = 0.24, $F(22,148) = 7.04$, $p < .001$. Follow-up orthogonal contrasts confirmed that the classifications were distinct from one another. As expected, children in the regular kindergartens scored highest, repeating kindergartners scored next, and children with disabilities scored lowest. The contrast between regular and repeating kindergartners (Wilks's lambda = 0.42, $p < .01$) showed that regular kindergartners were significantly younger than repeating kindergartners, had better receptive vocabulary and short-term memory for sounds, and scored higher on the standardized measures of reading and writing. They did not differ from their older peers on rapid letter naming or the phonological measures (blend, first sound, segment, rhyme, syllable deletion); this "equality" on

letter naming and phonological skills means that after an entire year of kindergarten, the repeaters scored similarly to regular kindergartners who were just beginning kindergarten for the first time.

The contrast between repeating kindergartners and children with mild disabilities was also significant (Wilks's lambda = 0.34, $p < .001$). Univariate tests revealed that the children with disabilities were younger, and scored significantly lower on all of the measures except the letter-word subtest of the WJ (scored by age).

Children in classes assigned to treatment or control status. Because the classes were not randomly assigned, we conducted separate MANOVAS between the treatment/control groups for each student type. None of the comparisons was significant. We report the pretest/posttest means and standard deviations for each student type by treatment/control status in Table 2.

Posttests

We analyzed student outcomes through a 2 (treatment/control) x 3 (student type) factorial design, covaried by the appropriate pretest score. Children in the self-contained special education classes, who had no control group, were not included in this analysis.

The effect of treatment. Analyses of covariance revealed no main effect for treatment on the PPVT-R or memory tests, or on tasks which were conducted in the treated and control classes (letter naming, first sound isolation, and rhyme). Significant main effects were found favoring treated groups for the blending and segmenting tests. Significant differences also favored treated children on the reading and writing measures (WJ letter-word identification and dictation subtests). Although treated children with disabilities performed better on these measures than their controls, their blending and segmenting gains were smaller than those of children without disabilities (regular or repeating kindergartners).

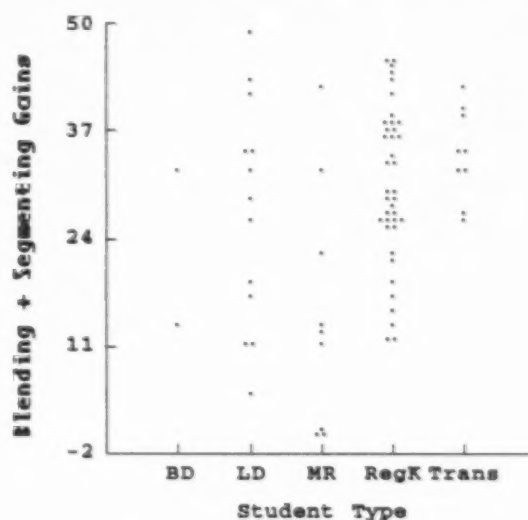
Table 3. Effects of Treatment and Student type on Outcomes, Covaried for Pretest

	MSe	Treatment		Treatment x Student Type	
		F(1,84)	p	F(2,84)	p
PPVT-R	185.35	2.42	.12	0.42	.66
Short-term memory	0.98	1.76	.19	1.58	.21
Letter naming	195.29	1.03	.31	0.79	.46
Rhyme	2.64	1.03	.31	2.54	.09
First sound	3.34	1.89	.17	0.19	.82
Blending	18.20	40.52	<.001	4.30	.02
Segmenting	36.93	53.12	<.001	3.58	.03
WJ letter-word	50.81	38.14	<.001	.77	.47
WJ dictation	79.72	23.74	<.001	1.31	.27

Differential treatment effects for students with various disabilities and placements

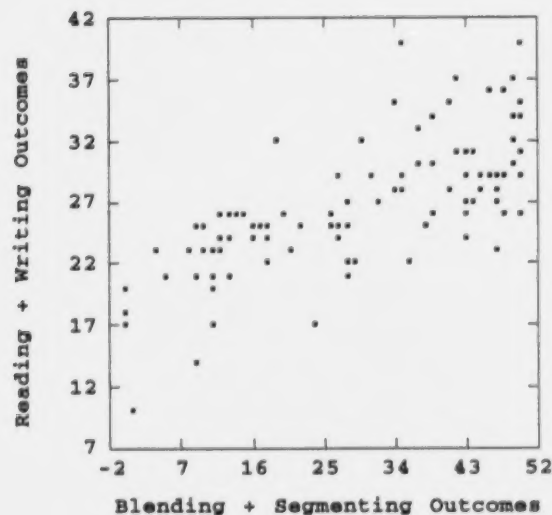
Reports of failure to learn during phonological instruction have haunted treatment studies which included very low-skilled children over the past several years. These reports are troubling because phonological skills may be difficult to teach, and particularly difficult for the children we hoped might benefit from them the most. We wanted to explore whether placement (in a self-contained or integrated class) or disability (among the mild disabilities) was related to progress in the phonological skill development of the treated children.

Gains for students with different types of disabilities. To explore growth in phonological skills for all of the treated children with and without disabilities ($n = 72$), we computed gain scores for the combined blending and segmenting measures. The figure below shows the gains made by each treated child with each disability (BD, LD, or MR), transition, or regular kindergarten category. Each dot represents the score of an individual child in that category. The range of gains in each category suggests that the type of disability students exhibit may not affect phonological growth in kindergarten when instruction is provided in those areas.



The threshold hypothesis

To explore the possibility of a phonological skills threshold for kindergartners, we created two composite scores: a phonological skills index of combined blending and segmenting posttest scores, and a literacy index of combined raw scores from the reading and writing posttests of the W-J. A scatter plot of these indices for the entire sample of 107 children (below) demonstrates the correlation between the two.



The mean raw score at the end of kindergarten on the composite of reading and writing was 27. This number represents the point at which a child can name individual letters correctly, and write letters named by the examiner. Progress beyond a score of 27 on this composite reflects reading and writing words, rather than individual letters. The figure is scaled to make the division at 27 along the Y axis easy. With one exception, all children who could read or write words scored higher than 26 on the blending/segmenting composite, the score that reflects the ability to blend and segment at the level of onsets and rimes. Notice that reading/writing words was not a necessary condition for high scores on the phonological composite.

Discussion

Implementation of Activities

Clearly the inservice was successful in stimulating the use of the activities we wanted teachers to include in the kindergarten day. That the minimum implementation was more than one activity daily suggests that we may be able to attribute increases in treated children's phonological blending and segmenting to the activities teachers conducted in the classrooms. We also found a wide range of implementation, with the highest number of activities more than double the lowest. Our interviews with teachers at the end of the year suggested two factors which particularly influenced the activities teachers used most frequently: the interface between a particular activity and the teacher's perception of the class needs; and the ease of implementation. The special

education classes had the greatest number of children with low skills, thus special educators were more inclined to implement activities perceived by other teachers as "too easy." Pretest scores support these instructional decisions, overall; however, it is also possible that the low-skilled children in higher-skilled classes received fewer of the low-level activities than they needed. Children with disabilities in the self-contained classes, where implementation of low-level activities was higher, made larger blending and segmenting gains (mean = 23) than their peers placed in integrated classes (mean = 19), although the difference was not significant.

Activities that required the dissemination or collection of materials for individual children (e.g., Elkonin boxes, individual letters for matching letters to spoken words, drawing and labeling pictures for a "pen pal" in another class) were used more frequently with small than with large groups, and the special education and transition classes spent a larger portion of their school day in small groups. It is likely that the amount of teacher assistant time available to help with activities in the different types of classes influenced the configuration for instruction as well as the frequency with which these activities were implemented. Teachers of smaller groups also asked the first author for modeling or assistance in conducting activities with particularly hard to teach children. It is possible that these teachers were more aware of the difficulties some children were having with activities, or that they were, by specialty, more likely to individualize instruction or insist upon participation from all of their students. These implementation issues could be addressed in future research.

Treatment outcomes

Across student types, children who had additional phonological activities incorporated into the school routine fared better on phoneme-level manipulations and reading/writing outcomes than untreated children; However, our design does not rule out the possibility of teacher effects. A stronger test would include more classrooms and use teacher as the unit of analysis, since the treatment was delivered to intact classes.

For children with mild disabilities, the levels of phonological blending and segmenting attained were not well predicted by where they received instruction (self-contained or integrated classrooms), or by the kind of disability they exhibited. Within each category of disability, some children learned the phonological manipulations and others did not. Figure 2 shows the range and frequency of gains in blending and segmenting by children in the treated classes. Children repeating kindergarten made stronger gains than most children with disabilities in any of the categories. This finding sustains that of Innocenti and White (1993), who also found generally lower effects in studies that used students with disabilities as subjects than for studies using children "at risk" without disabilities. The superior gains of children in the transition class are

confounded, however, with concomitant small amounts of reading instruction, older age, and a second year of exposure to kindergarten objectives.

We judged that treated children who made less than half the average gain of other treated children had made low growth in phonological skills, and used this criterion to consider our participants as low growers or high growers. As Figure 2 shows, more children who made only small gains in the treated classes fell into the MR category than any other; nevertheless, three children with MR made substantial progress. Thus it appears unlikely that the category of disability, alone, would assist in making a priori predictions about which children will profit from blending or segmenting instruction. Overall, 33% of the children with disabilities in the treated sample made low phonological gains, which is about the same as reported in other studies that include gains made by individual subjects. The children with disabilities in this study were also lower functioning than those in studies that excluded children receiving special education services, however, we may have offset their relatively lower ability by providing a more prolonged treatment. A shorter intervention--comparable to the 7-12 week interventions reported by Ball and Blachman (1991), Cunningham (1990), and Torgesen et al. (1992)--may have resulted in higher numbers of children with disabilities classified as low growers. Taking more frequent measures over the course of future treatments may inform considerations of optimal length and conditions for early intervention in phonological manipulation skills.

Although children with disabilities performed better on the phonological and reading measures in the treated than the untreated groups, improved performance did not bring them to the level of their typically developing peers. Children with LD, BD, or mild MR averaged smaller gains, and remained lower in skills at the end of the year. It is important to balance the overall lower gains of students with disabilities with the information that matched children with the same disabilities and academic profiles in the control classes did not make significant pretest to posttest gains on any of the phonological measures.

A Threshold Hypothesis

Several studies have suggested a facilitative model for the relations between phonological awareness and the acquisition of beginning reading and spelling skills, and we wanted to explore that possibility in our data. Torneus (1984), Perfetti et al. (1989), and Lie (1991) found that the effects of phonological training on reading and spelling were stronger for children who began treatment with below-average phonological skills. This finding has been used as evidence to support a threshold argument: that at some point along a continuum of phonological ability, more training (or higher phonological skills) adds no advantage to reading. Thus the goal of treatment may be to bring more children to this threshold level. For students with disabilities, it may be

particularly critical to explore first whether such a threshold exists, and if so, how best to achieve progress over the threshold.

Figure 3 suggests a minimum level of competence in phonological manipulation needed for reading, but not a level beyond which no further facilitation occurs. The relation demonstrated by the scatter of scores indicates that to progress from reading/writing letters to reading/writing words required the ability to blend and segment spoken words beyond the level of onset-rime, and toward an awareness of the internal structure of spoken words. The figure also shows the direction of facilitation: It was not necessary to read and write words to be able to blend and segment 3-phoneme words accurately. This study did not test an upper limit of phonological facilitation for kindergartners. Six children reached ceiling on the phonological tasks, so that our measures did not provide a sufficient upward range to find a maximum desirable level, if one exists.

Implications for instruction

This study was designed to explore the effects of activity-based group instruction on the phonological development and reading/writing outcomes of students across a range of ability. The unique aspect of this project is that teachers taught their own groups of children, using methods they learned under inservice conditions. According to teacher interviews, the activities "fit right in; they're not anything so unusual that you wouldn't find an appropriate time to use them." Teachers also mentioned increasing their own knowledge about how children acquire early reading skills and the alphabetic principle. "I think it's enhanced my feelings of competence in reaching the needs of children. It's made an impact on my teaching, and I feel more effective in reaching children through these activities."

We observed a wide range of implementation, suggesting that the kinds of materials used in many of the intervention studies--say-it-and-touch-it (Ball & Blachman, 1991; Williams, 1980), letter to word matching (Yopp, 1988), and odd word out (Bradley & Bryant, 1985)--are difficult to manage in large classroom groups. Activities with fewer materials, such as songs to isolate phonemes in words (Yopp, 1992), representing phonemes with finger cues (O'Connor et al., 1993), and guessing games (O'Connor et al., in press) appear to be easier for teachers to execute.

Several recent articles (Blachman, 1994; Torgesen, Wagner, & Rashotte, 1994; Wagner et al., 1993) acknowledge the problems with one year studies: we improve phonological skills, find effects on low-level reading skills (e.g., this study; Ball & Blachman, 1991), or on reading analogs (Fox & Routh, 1984; O'Connor et al., in press; Torgesen et al, 1992), but the strong test of intervention will be in better acquisition of reading throughout the primary grades for children predicted to fail. As a feasibility test, this study suggests that classrooms teachers can improve the phonological skills of their students prior to formal reading instruction. To make large and lasting

differences in the reading trajectory of children with disabilities, instruction may need to be much more intense than that delivered to large classroom groups.

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